Roller Coaster Simulator for the Magnetic Chalkboard: Construction Plans

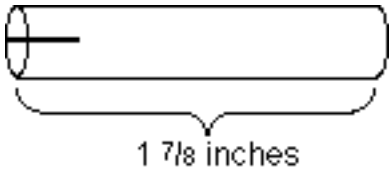
This is a demo that mounts on a blackboard that is magnetic. This demo will allow the teacher to demonstrate Galileo's inertia experiment and how and why the hills on roller coasters are designed the way they are. When it is built, it will be an adjustable rail road type track.
Materials:

- 12 feet of vinyl tubing with an outside diameter of $^1/_4$ inch. Some larger hardware stores sell the tubing. (20¢ per foot)
- 18- $1^1/_8$ inch diameter magnets from Radio Shack.

- $37^1/_2$ inches of dowel rod $^3/_8$ inches in diameter .
- 1 small tube of contact cement
- 1 tube of Household GOOP® or any other adhesive that will glue vinyl. (Epoxy will not work.)

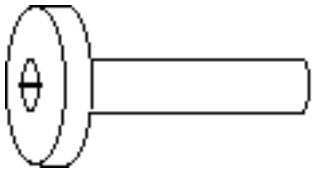
STEP 1

Cut the dowel rod into 20 pieces $1^7/_8$ inches long. Cut a $^1/_4$ deep slit into one end of each dowel rod. The slit should be about $^1/_{16}$ inch wide. A band saw is a good tool for doing this.



STEP 2

Insert the slit end of each dowel into a magnet.

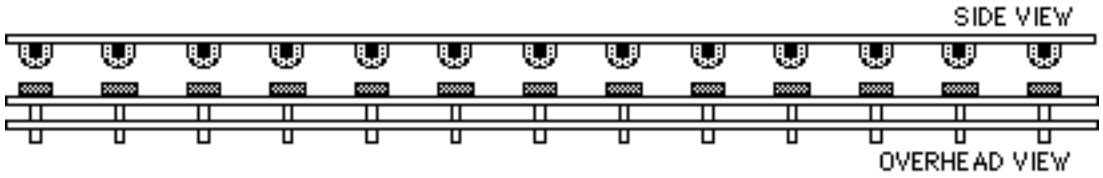


STEP 3

Cut some wood into $^{1}/_{4}$" X $^{1}/_{4}$" X $1^{1}/_{2}$" RECTANGLES. These will be used as spacers. Mark the tubing every 4 inches with a permanent marker. Place the magnets on the board in a straight line 4 inches apart from each other.

STEP 4

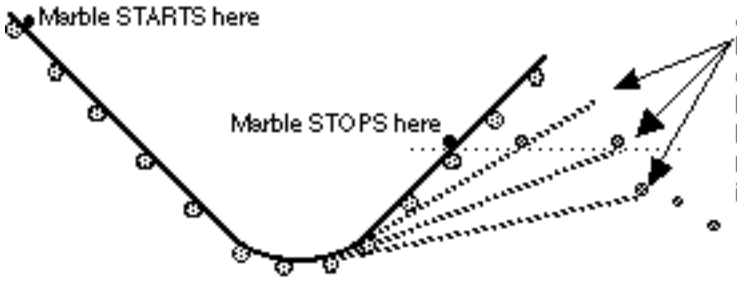
Put some contact cement on the top side of each dowel rod. Put some more contact cement on the vinyl tubing at each mark. With another person's help, lay the tubing against the magnets on top of the dowel. When you have laid out 18 magnets, 6 feet, stop. Cut the tubing. Lay the other piece of tubing $^{1}/_{4}$ inch away from the first piece. Use the cut wood as a spacer between the vinyl tubing. It should look like rail road tracks when you are done



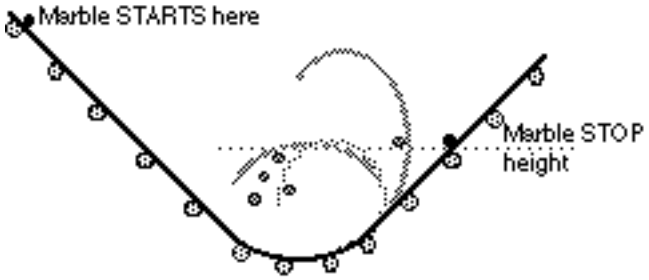
STEP 5

Final step. The track's glue joints are weak. Reinforce them with GOOP™ on the underside. Be sure not to get any glue on top of the tubing. A little piece of glue on top of the tubing will cause the marble to roll off it.

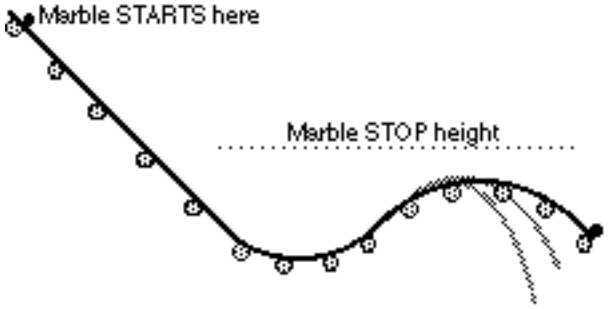
USING THE ROLLER COASTER SIMULATOR



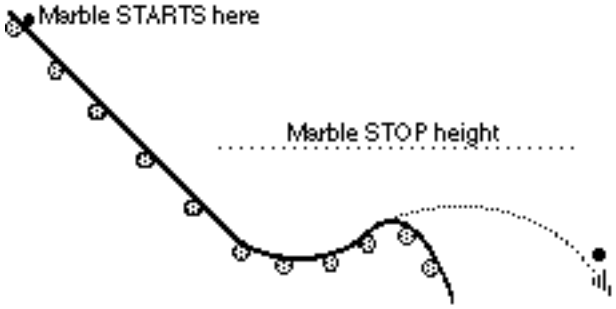
Adjust the ramp to lower angles. The marble keeps rolling to the same height. Galileo concluded from a similar experiment that the ball will keep rolling until it reaches the same height it started from if there were no friction. (With friction, it will keep rolling until it reaches the stop height.)



Adjust the ramp to different loop radii. Notice if the loop's radius is too big, the marble falls off. Try adjusting the radius until the ball makes it around the loop.



Adjust the ramp to different hill shapes. Drop the marble from the same height each time. Keep adjusting the hill's shape until the marble no longer leaves the track. This is the desired hill shape for that start height. After all, if the roller coaster left the tracks each time, the company would lose its customers. (Try a lower start height and see how the hill shape would change.)



Adjust the ramp to make a gradual climb on the left side and steep drop on the right. Trace the path the bottom of the ball makes as it leaves the track. Line the track up with the traced curve. The ball will stay on the track. A coaster's hills are designed to give the rider the weightless feeling they would get if the track were not there.

PRACTICE SPEED ESTIMATION

Each support is 4 inches apart. To estimate the velocity at the bottom of this curve, count an equal number of supports on each side of the dip's center. Calculate this distance. Time how long the ball takes to travel the distance. Calculate the average speed, (distance/time). The average will equal the exact speed at the center of the dip -but only if (1) the distance measured is equal on both sides of the dip's center and (2) the region measured is fairly symmetrical in shape.

If you use or find this page useful or have any comments, please contact the author so maybe he'll do more. Author: Tony Wayne e-mail: wayne@pen.k12.va.us

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